

CLAIMS

1 ~~1. A system for managing ink information in a computer system having a pen-based~~
2 ~~input tablet, the system comprising:~~
3 ~~a pen driver coupled to the pen-based input/display tablet and configured to col-~~
4 ~~lect and organize the ink information entered at the pen-based input tablet into ink~~
5 ~~strokes;~~
6 ~~an ink memory area organized into one or more ink phrase data structures; and~~
7 ~~an ink manager coupled to the pen driver for receiving the ink strokes, the ink~~
8 ~~manager having an ink phrase termination engine configured to examine the ink informa-~~
9 ~~tion collected by the pen driver and, upon detecting the occurrence of an ink phrase ter-~~
10 ~~mination event, to identify a respective end of an ink phrase to the ink manager,~~
11 ~~whereby the ink manager stores the ink strokes received prior to the ink phrase~~
12 ~~termination event in a selected ink phrase data structure.~~

1 2. The system of claim 1 wherein
2 the ink information entered at the pen-based input tablet is associated with a client
3 application, and
4 the ink manager, in response to the occurrence of an ink phrase termination event,
5 is configured to pass the un-recognized ink strokes of the respective ink phrase to the cli-
6 ent application.

1 3. The system of claim 2 wherein the ink manager, in response to receiving from the
2 client application a reference context affiliated with the un-recognized ink strokes of the
3 ink phrase, associates the reference context with the ink strokes.

1 4. The system of claim 3 wherein the ink manager associates the reference context
2 with the un-recognized ink strokes by appending the reference context to the selected ink
3 phrase data structure.

1 ~~5. The system of claim 2 wherein the ink phrase termination engine is configured to~~
2 ~~initiate a time-out for each ink stroke and further wherein the termination engine identi-~~
3 ~~fies the occurrence of an ink phrase termination event when the time-out expires before~~
4 ~~the next sequential ink stroke is detected.~~

1 6. The system of claim 5 wherein the time-out has a value that is settable by a user
2 of the computer system.

1 7. The system of claim 5 wherein the pen-based input tablet has a surface and the
2 ink information generated by the tablet includes out-of-proximity data corresponding to
3 the pen being lifted above the surface of the tablet, and further wherein the termination
4 engine detects the occurrence of an ink phrase termination event upon detecting out-of-
5 proximity data from the tablet.

1 8. The system of claim 2 further comprising:
2 one or more handwriting recognition engines for generating hypotheses based on
3 the ink information entered at the pen-based tablet; and
4 a handwriting recognition manager coupled to both the ink manager and the one
5 or more handwriting recognition engines, the handwriting recognition manager config-
6 ured and arranged to coordinate operation of the one or more handwriting recognition
7 engines, wherein
8 the ink strokes received at the ink manager are passed to the handwriting
9 recognition manager, and
10 the ink manager notifies the handwriting recognition manager of the oc-
11 currence of each ink phrase termination event and, in response, the handwriting
12 recognition manager directs a selected handwriting recognition engine to generate
13 one or more hypotheses for the ink strokes corresponding to the respective ink
14 phrase.

1 9. The system of claim 8 wherein the handwriting recognition manager in coopera-
2 tion with the selected handwriting recognition engine employs a word segmentation

3 ~~model to the ink strokes as they are received by the ink manager and, in response to de-~~
4 ~~termining that a given ink stroke represents a new word, is permitted to issue an ink~~
5 ~~phrase termination signal to the ink manager.~~

1 10. The system of claim 8 wherein
2 the client application is configured to define at least one data entry field for dis-
3 play on the tablet and to establish corresponding boundary coordinates for the at least one
4 data entry field, and
5 the termination engine identifies the occurrence of an ink phrase termination
6 event when an ink stroke or portion thereof is outside of the boundary coordinates for the
7 at least one data entry field.

1 11. The system of claim 8 wherein the one or more hypotheses are provided to the
2 client application.

1 12. The system of claim 8 wherein the ink manager
2 in response to receiving from the client application a reference context affiliated
3 with the un-recognized ink strokes of the ink phrase, associates the reference context with
4 the ink strokes, and
5 in response to a request by the client application, returns the affiliated reference
6 context to the client application together with the one or more hypotheses.

1 13. The system of claim 8 wherein, in response to receiving an indication that the cli-
2 ent application has consumed the un-recognized ink strokes, the ink manager directs the
3 handwriting recognition manager not to generate one or more hypotheses for the ink
4 strokes.

1 14. The system of claim 8 wherein
2 in response to receiving the un-recognized ink strokes, the client application es-
3 tablishes a corresponding recognition context for the ink strokes, and

4 ~~the handwriting recognition manager receives the recognition context and directs~~
5 the selected handwriting recognition engine to utilize the recognition context in generat-
6 ing the one or more hypotheses.

1 15. The system of claim 14 wherein the one or more hypotheses generated by the se-
2 lected handwriting recognition engine utilizing the recognition context from the client
3 application are provided to the client application.

1 16. A method for managing ink information in a computer system having a pen-based
2 input tablet that may include an integrated display for generating ink information as a pen
3 is moved across the tablet, the method comprising the steps of:

4 receiving the ink information generated by the input tablet;
5 identifying when the pen is lifted from the tablet so as to organize the ink infor-
6 mation into corresponding ink strokes; and
7 organizing the ink strokes into one or more ink phrases as defined by one or more
8 ink phrase termination events.

1 17. The method of claim 16 wherein the step of organizing comprises the steps of:
2 examining the ink information to determine whether an ink phrase termination
3 event has occurred; and

4 in response to the occurrence of an ink phrase termination event, segregating the
5 ink strokes received prior to the termination event in a designated ink phrase data struc-
6 ture.

1 18. The method of claim 17 wherein the ink information entered at the tablet is asso-
2 ciated with a client application, the method further comprising the step of optionally
3 passing the un-recognized ink strokes of the respective ink phrase to the client application
4 in response to the ink phrase termination event.

1 19. The method of claim 18 further comprising the step of, in response to receiving a
2 reference context from the client application affiliated with the un-recognized ink strokes
3 of the ink phrase, associating the reference context with the ink strokes.

1 20. The method of claim 19 wherein the reference context is associated with the re-
2 spective ink phrase by appending the reference context to the designated ink phrase data
3 structure.

1 21. The method of claim 17 wherein the ink information enter at the tablet is associ-
2 ated with a client application, the method further comprising the steps of:
3 generating one or more recognition hypotheses for the ink strokes of the ink
4 phrase data structure; and
5 passing the one or more recognition hypotheses to the client application together
6 with the respective reference context.

1 22. The method of claim 17 wherein the ink information from the input tablet further
2 includes out-of-proximity data which corresponds to the pen being lifted above a surface
3 of the tablet, the method further comprising the steps of:
4 examining the ink information to detect out-of-proximity data;
5 identifying the occurrence of an ink phrase termination event in response to de-
6 tecting out-of-proximity data.

1 23. The method of claim 17 wherein the ink information entered at the tablet is asso-
2 ciated with a client application, and the client application defines a form for display on
3 the tablet, the form having one or more data entry fields for receiving handwritten infor-
4 mation, the method further comprising the steps of:
5 receiving a set of bounding coordinates established by the client application for
6 the one or more data entry fields;
7 comparing the ink information from the input tablet with the bounding coordi-
8 nates of the one or more data entry fields; and

9 ~~identifying the occurrence of an ink phrase termination event in response to de-~~
10 ~~tecting ink information moving outside of the bounding coordinates for at least one of the~~
11 ~~one or more data entry fields.~~

1 24. The method of claim 17 wherein the computer system includes at least one recog-
2 nition engine, the method further comprising the steps of:
3 optionally configuring the recognition engine to apply a word segmentation model
4 to the ink strokes as they are organized; and
5 identifying the occurrence of an ink phrase termination event when the word seg-
6 mentation model determines that a given ink stroke is part of a new word relative to an
7 immediately prior ink stroke.

1 25. The method of claim 17 further comprising the steps of:
2 initiating a time-out mechanism upon receipt of each ink data point; and
3 identifying the occurrence of an ink phrase termination event when the time-out
4 expires prior to receiving a next sequential ink data point.

1 26. The method of claim 25 wherein the ink information from the input tablet further
2 includes out-of-proximity data which corresponds to the pen being lifted above a surface
3 of the tablet, the method further comprising the steps of:
4 examining the ink information to detect out-of-proximity data;
5 identifying the occurrence of an ink phrase termination event in response to de-
6 tecting out-of-proximity data.

1 27. A computer readable medium containing executable program instructions for or-
2 ganizing ink information generated by a pen-based input tablet as a pen moves across the
3 tablet, the executable program instructions comprising program instructions for:
4 receiving the ink information generated by the input tablet;
5 identifying when the pen is lifted from the tablet so as to organize the ink infor-
6 mation into corresponding ink strokes;

7 ~~examining the ink information to determine whether an ink phrase termination~~
8 event has occurred; and
9 in response to the occurrence of an ink phrase termination event, segregating the
10 ink strokes received prior to the termination event in a designated ink phrase data struc-
11 ture.

1 28. The computer readable medium of claim 27 wherein the ink information entered
2 at the tablet is associated with a client application, the medium further comprising pro-
3 gram instructions for passing the un-recognized ink strokes of the respective ink phrase to
4 the client application in response to the ink phrase termination event.

1 29. The computer readable medium of claim 28 further comprising program instruc-
2 tions for, in response to receiving an indication that the client application has consumed
3 the un-recognized ink strokes, blocking recognition of the ink strokes.

1 30. The computer readable medium of claim 28 further comprising program instruc-
2 tions for, in response to receiving a reference context from the client application affiliated
3 with the un-recognized ink strokes of the ink phrase, associating the reference context
4 with the ink strokes.

1 31. ~~The computer readable medium of claim 30 wherein the reference context is asso-~~
2 ~~ciated with the ink strokes by appending the reference context to the designated ink~~
3 ~~phrase data structure.~~

1 32. The computer readable medium of claim 27 wherein the ink information entered
2 at the input tablet is associated with a client application, the computer readable medium
3 further comprising program instructions for:
4 generating one or more recognition hypotheses for the ink strokes of the ink
5 phrase data structure; and
6 passing the one or more recognition hypotheses to the client application.

1 33. ~~The computer readable medium of claim 32 further comprising program instruc-~~
2 tions for:

3 in response to receiving a reference context from the client application affiliated
4 with the un-recognized ink strokes of the ink phrase, associating the reference context with
5 the ink strokes; and

6 in response to a request from the client application, returning the reference con-
7 text to the client application along with the one or more recognition hypotheses.

1 34. The computer readable medium of claim 32 wherein the client application estab-
2 lishes a recognition context in response to receiving the un-recognized ink strokes of the
3 ink phrase and the program instructions from generating one or more recognition hy-
4 potheses further comprise program instructions for utilizing the recognition context es-
5 tablished by the client application.

1 35. The computer readable medium of claim 27 wherein the program instructions for
2 examining comprise program instructions for:

3 initiating a time-out mechanism upon receipt of each ink data point; and
4 identifying the occurrence of an ink phrase termination event when the time-out
5 expires prior to receiving a next sequential ink data point.

1 36. The computer readable medium of claim 35 wherein the ink information further
2 includes out-of-proximity data which corresponds to the pen being lifted above a surface
3 of the tablet, and the program instructions for examining further comprise program in-
4 structions for:

5 examining the ink information to detect out-of-proximity data;
6 identifying the occurrence of an ink phrase termination event in response to de-
7 tecting out-of-proximity data.